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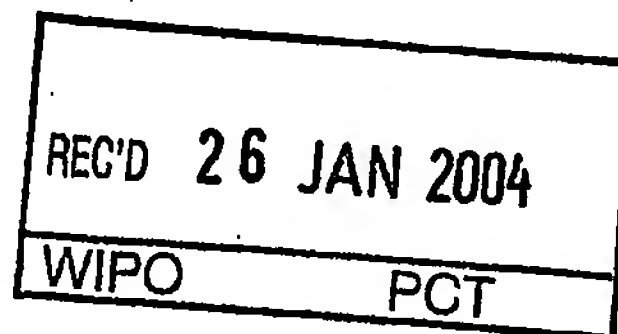
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**APPLICATION NUMBER: 60/425,679**

**FILING DATE: November 12, 2002**

**RELATED PCT APPLICATION NUMBER: PCT/US03/35933**



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PROV

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Box PROVISIONAL PATENT APPLICATION  
Assistant Commissioner for Patents  
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60/425679

PROVISIONAL PATENT APPLICATION COVER SHEET

- A) Enclosed for filing is a provisional patent application.
- B) Name of inventors: Gary Nolen, Kelly Beers, and Joe Rheingans
- C) Residence of inventors: Lowell, Arkansas, Fayetteville, Arkansas, and Shelbyville, Tennessee, respectively
- D) Title of invention: Antimicrobial Application System with Recycle
- E) Name and registration number of attorney: Mark Rogers, Registration No. 34,238
- F) Attorney docket no.: SF5315
- G) Correspondence address: Mark Rogers, Speed & Rogers, P.A., 1701 Centerview, Suite 125, Little Rock, Arkansas 72211, (501) 219-2800
- H) Name of U.S. Government agency and Government contract no. (if applicable): N.A.

Accompanying this cover sheet are:

- 1) 9 pages of specification;
- 2) 1 page of drawings;
- 3) check in the amount of \$80.00; and
- 4) return postcard.

This application is entitled to small entity status.

Respectfully submitted,

*Mark Rogers*

Mark Rogers

Registration No. 34,238

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"Express Mail" Mailing Label Number EE652370-762 US. I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 addressed to the Commissioner for Patents, Washington, D.C. 20231, on the following date

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*Mark Rogers*  
Mark Rogers

## ANTIMICROBIAL APPLICATION SYSTEM WITH RECYCLE

### Background of the Invention

5 This invention relates to an antimicrobial application system, and more particularly to an antimicrobial application system with recycle features.

Antimicrobial application systems, including spray cabinets are known in the art. U.S. Patent Application Serial Number 10/001,896, filed on November 19, 2002 by Gary Nolen, discusses a number of such systems and highlights a number of the advantages and disadvantages of these systems. The disclosure of U.S. Patent Application Serial Number 10/001,896 (Nolen) is incorporated herein by reference. The spray application systems disclosed in that application offer a number of advantages over earlier systems, as discussed in more detail in that application. Still, the present inventors have further refined and built upon those systems to offer alternate embodiments offering additional flexibility. For example, it may be desirable to recycle the antimicrobial that is applied to the workpieces. Adding equipment and steps to allow for recycling adds to the cost and complexity of a system, so it will not always be preferred. Still, using recycling reduces consumption of antimicrobial and water and reduces the amount of waste material in need of disposal. This may be desirable for any number of reasons such as environmental concerns, raw material costs, raw material storage limitations, disposal costs, and regulatory issues involving disposal of wastewater and some antimicrobials. Accordingly, under many circumstances, it will be desirable to recycle the antimicrobial for multiple applications to workpieces to be treated.

Recycling of liquids applied to workpieces in a process line is generally known in the art. Still, recycling liquids in connection with food processing and items associated with food processing presents a number of special issues and concerns, particularly concerning contamination and cross contamination. These concerns typically argue against recycling or lead to the use of slow, cumbersome, undesirable extra steps and extra equipment that add to the cost and complexity of a system. One such cumbersome, inflexible system is disclosed in U.S. Patent No. 6,348,227, issued to Caracciolo, Jr. in 2002, the disclosure of which is incorporated herein by reference.



# Summary of the Invention

It is therefore an object of the present invention to provide an antimicrobial application  
5 system that provides for the safe, effective, and cost efficient recycling of antimicrobial in connection with food processing and items associated with food processing.

It is a further object of the present invention to provide a system of the above type that reduces raw material consumption without sacrificing safety.

It is a still further object of the present invention to provide a system of the above type  
10 that provides for periodic, batch style separation and disposal of spent antimicrobial.

It is a still further object of the present invention to provide a system of the above type which automatically monitors and maintains a desired composition of the antimicrobial solution to be recycled.

It is a still further object of the present invention to provide a system of the above type  
15 which provides for improved recapture and return of an antimicrobial solution applied to workpieces.

It is a still further object of the present invention to provide a system of the above type which automatically compensates for additional liquids passing from wetted workpieces to the recycled antimicrobial solution.

It is a still further object of the present invention to provide a system of the above type  
20 which provides continuous, real-time monitoring and control of the composition of an antimicrobial solution.

It is a still further object of the present invention to provide a system of the above type which reduces waste leaving the system and waste disposal costs associated therewith.

It is a still further object of the present invention to provide a system of the above type  
25 which provides a safe waste stream that may be safely drained into a wastewater system.

It is a still further object of the present invention to provide a system of the above type that increases the flexibility and advantages of the spray application systems and spray cabinets disclosed in U.S. Patent Application Serial Number 10/001,896 (Nolen).

Toward the fulfillment of these and other objects and advantages, the antimicrobial application system of the present invention comprises an antimicrobial application unit and a recycle unit. An initial, dilute antimicrobial solution is prepared in a recycle tank in the recycle unit. The solution is provided to the antimicrobial application unit and applied to workpieces, such as raw poultry. After application to the workpieces, the solution is returned to the recycle tank. The concentration of the antimicrobial in the recycle tank is constantly monitored, and additional antimicrobial is automatically added to the recycle tank if the concentration of the antimicrobial in solution falls below a desired amount. At the end of a spray cycle, the solution is diverted to a purge tank, and the antimicrobial is separated from the solution. The separated components are then disposed of in appropriate manners. The antimicrobial is preferably a quaternary ammonium compound, is more preferably an alkylpyridinium chloride, and is most preferably cetylpyridinium chloride.

#### Brief Description of the Drawing

The above brief description, as well as further objects, features and advantages of the present invention will be more fully appreciated by reference to the following detailed description of the presently preferred but nonetheless illustrative embodiments in accordance with the present invention when taken in conjunction with the accompanying drawing, wherein:

FIG. 1 is schematic view of an antimicrobial application system of the present invention.

#### Detailed Description of the Preferred Embodiment

Referring to Fig. 1, the reference numeral 10 refers in general to an antimicrobial application system of the present invention. The antimicrobial application system 10 of the present invention generally comprises an antimicrobial application unit 12 and a recycle unit 14.

The antimicrobial application unit 12 may take any number of configurations. In the preferred embodiment, the antimicrobial application unit 12 takes the general form of one of the embodiments of a spray application system as disclosed in U.S. Patent Application Serial

Number 10/001,896 (Nolen). A conveyor 16 passes through a housing 18 for moving workpieces 20, such as raw poultry, through the housing 18. As described in more detail below, a drip tray or pan 22 extends downstream of the housing 18, disposed below the conveyor 16 and the workpieces 20 carried thereby. The spray application systems are discussed in detail in U.S. Patent Application Serial Number 10/001,896 (Nolen) and will not be discussed in more detail here. It is of course understood that the antimicrobial application unit 12 is not limited to those embodiments or to spray application systems in general. The antimicrobial application unit 12 may apply an antimicrobial to any number of different types of workpieces 20 in any number of different conventional ways. Methods of application used by such an antimicrobial application unit 12 may include but are not limited to spraying, misting, fogging, immersing, pouring, dripping, and combinations thereof. It is understood that the system 10 may be used to treat a wide variety of different workpieces 20, including but not limited to meat, poultry, fish, fruits, vegetables, other foodstuffs, animals, food packaging, and items and surfaces related to food or food processing. It is also understood that the workpieces 20 may be live, dead, raw, cooked, prepared, processed, partially processed, or ready to eat. It is also understood that the system 10 may be used to treat workpieces 20 completely unrelated to food or food processing items.

The recycle unit 14 dilutes a concentrated antimicrobial solution to obtain a dilute antimicrobial solution and provides the dilute antimicrobial solution to the antimicrobial application unit 12. A recycle tank 24 is provided. The recycle tank 24 may include an impeller or some other stirring or agitation means. A source of potable water 26, such as tap water, is connected to the recycle tank 24 via water supply line 28. Similarly, an antimicrobial source, such as a supply tank 30, is connected to the recycle tank 24 via antimicrobial supply line 32. The antimicrobial preferably comprises a quaternary ammonium compound, more preferably comprises an alkylpyridinium chloride, and most preferably comprises cetylpyridinium chloride. More particularly, the concentrated antimicrobial solution preferably comprises a concentrated solution of a quaternary ammonium compound as described in U.S. Patent Application Serial Number 09/494,374, filed on January 31, 2000 by Compadre et al. The disclosure of U.S. Patent Application Serial Number 09/494,374 (Compadre et al.) is incorporated herein by reference. The concentrated solution preferably comprises an antimicrobial and a solubility enhancing

agent, and the solubility enhancing agent preferably comprises propylene glycol. The quaternary ammonium compound is preferably present in the concentrated solution in a weight percent of approximately 40%, and the solubility enhancing agent is preferably present in the concentrated solution in a weight percent of approximately 60%. It is of course understood that any number of  
5 different antimicrobials and solubility enhancing agents may be used, and the concentrated and dilute solutions may have any number of different components and compositions, including but not limited to the components and compositions of the concentrated and dilute solutions disclosed in U.S. Patent Application Serial Number 09/494,374 (Compadre et al.). Concerns of contamination or cross-contamination are eliminated or alleviated because of the broad spectrum  
10 efficacy of the preferred antimicrobial solutions.

A chemical feed pump 34, such as a metering pump is disposed in antimicrobial supply line 32. A sensor 36 is connected to the recycle tank 24 via lines 38 and 40. In the preferred embodiment, the sensor is an ultraviolet light photospectrometer or UV spec sensor. Of course it is understood that any number of different types of sensors 36 may be used, including but not  
15 limited to infrared, visible light, or ultraviolet sensors. The sensor 36 is capable of detecting the concentration of the antimicrobial in the solution in the recycle tank 24. A controller 42 operably connects the sensor 36 to the chemical feed pump 34. The controller 42 is capable of receiving a signal from the sensor 36 and sending a corresponding on/off signal to the chemical feed pump 34. A feed line 44 exits the recycle tank 24, passes through the system pump 46, through a valve  
20 48, and connects to the antimicrobial application unit 12. Multiple feed lines may be used, or the feed line 44 may be branched or divided, if desired, to connect the recycle tank 24 to multiple antimicrobial application units. The valve 48 is preferably a three-way valve. A return line 50 exits the antimicrobial application unit 12, passes through a filter 52, and connects to the recycle tank 24. Multiple return lines may be used to connect multiple antimicrobial application units to  
25 the recycle tank 24. The filter 52 is preferably a wire mesh filter sized to capture visible particulates in the effluent from the antimicrobial application unit 12. Visible particulates in the effluent will typically be minimal because of upstream washing that will typically be performed on the workpieces 20. A purge line 54 passes from the valve 48 to a purge tank 56. A drain line 58 passes from the purge tank 56 to an antimicrobial separation unit 60. The antimicrobial



separation unit 60 preferably comprises one or more disposable filters selected to separate the antimicrobial from water. A disposal line 62 exits the antimicrobial separation unit 60 for disposing of water after the antimicrobial is removed. A central control unit 64 is used to control the entire system 10.

5 In operation, a dilute antimicrobial solution will typically be prepared and used for one spray cycle that will typically last for one day. The dilute antimicrobial solution will then discarded, disposed of, or removed from the system 10 for further processing. Accordingly, each spray cycle, typically beginning each morning, begins with an empty and clean recycle tank 24 and an empty and clean purge tank 56. Before the antimicrobial application unit 12 is activated, 10 and before the system pump 46 is turned on, the dilute antimicrobial solution is prepared. In that regard, a desired amount of tap water is fed to the recycle tank 24. The recycle tank 24 is preferably filled to approximately one third to approximately one half of its capacity with potable water. The central control unit 64 activates the sensor 36 so that liquid from the recycle tank 24 passes through the sensor 36. The sensor 36 initially detects the absence of antimicrobial (no 15 absorbance at 260 nm), so the controller 42 activates the chemical feed pump 34 to begin metering the concentrated antimicrobial solution into the recycle tank 24. When the concentration of the antimicrobial in the dilute solution in the recycle tank 24 reaches a desired level, the sensor 36 and, in turn, the controller 42 turn off the chemical feed pump 34. The desired ranges of the concentration of antimicrobial in dilute solution include but are not limited 20 to the concentration ranges of the antimicrobial in the dilute solutions disclosed in U.S. Patent Application Serial Number 09/494,374 (Compadre et al.). Once the desired concentration is obtained in the recycle tank 24, the system pump 46 is activated, and the dilute solution is supplied to the antimicrobial application unit 12. The dilute solution provided to the antimicrobial application unit 12 is not potable. Still, contamination or cross-contamination of 25 the workpieces 20 is not a concern because of the safety and broad spectrum efficacy of the dilute antimicrobial solution used. The recycle unit 14 supplies the dilute antimicrobial solution to the antimicrobial application unit or units 12 at any number of different flow rates and pressures. These flow rates and pressures may include, but are not limited to, the flow rates and pressures discussed in U.S. Patent Application Serial Number 10/001,896 (Nolen).



Once the recycle unit 14 is supplying the dilute antimicrobial solution to the antimicrobial application unit 12, the workpieces 20 to be processed, such as raw poultry, are moved by the conveyor 16, through the housing 18, and the dilute antimicrobial solution is applied to the workpieces 20, such as by spraying. The portion of the dilute antimicrobial solution that does not adhere to the workpieces 20 collects in a drain and is returned via return line 50, through filter 52, and to the recycling tank for reuse. The length of the drip tray 22 is selected so that it will catch drops from workpieces 20 exiting the housing 18 for approximately 1 minute after the workpieces 20 exit the housing 18. This enhances the recovery of the dilute antimicrobial solution and reduces downstream losses. Water spray curtains may be used in the application chamber, and the workpieces 20 may be wet from upstream washing, so additional water will typically enter the recycle tank 24.

The sensor 36 continuously monitors the concentration of the antimicrobial in solution in the recycling tank. If the concentration falls below a desired amount, the sensor 36 activates the chemical feed pump 34 to add more of the concentrated antimicrobial solution and to bring the concentration of the antimicrobial in the dilute antimicrobial solution back up to the desired level. The system 10 can be configured to allow the tap water to be controlled in this fashion as well, but it is unlikely that there will be a need to add water. The dilute antimicrobial solution is thereby used repeatedly to treat any number of units of the workpieces 20 being processed.

At the end of the spray cycle, such as at the end of a shift or a day or other chosen period of time, the valve 48 is actuated to divert the dilute antimicrobial solution received from the system pump 46 through purge line 54 to the purge tank 56. The liquid in the purge tank 56 is gravity fed through the drain line 58 to the disposable filters of the antimicrobial separation unit 60. The disposable filters capture the antimicrobial to separate the antimicrobial from the solution. The antimicrobial impregnated filters are then disposed of in an appropriate manner, such as by incineration or disposal at an approved landfill. The remaining, relatively antimicrobial-free liquid is then disposed of in an appropriate manner, such as by being drained into a wastewater system of a plant. The frequency with which the system 10 will need to be purged will depend upon any number of factors, such as the number of workpieces 20 to be processed by the antimicrobial application unit 12 and the volume of the dilute antimicrobial

solution required to charge the system 10 at the beginning of a spray cycle. A periodic purge of the system 10 will be used.

Other modifications, changes and substitutions are intended in the foregoing, and in some instances, some features of the invention will be employed without a corresponding use of other features. For example, the antimicrobial application unit 12 may take any number of forms, shapes, and sizes and need not be one of the spray cabinet embodiments disclosed in U.S. Patent Application Serial No. 10/001,896 (Nolen). Similarly, any number of different antimicrobials may be used in any number of different concentrations. Further, any number of different separation techniques may be used in the antimicrobial separation unit 60, and the antimicrobial separation unit 60 may be used with or without a corresponding use of a purge tank 56. Further still, additional pumps, filters, and similar components may be incorporated into the system 10. Also, any number of different methods may be used to monitor the composition of the solution in the recycle tank 24. Similarly, the composition need not be monitored constantly but may be monitored at desired intervals. Further still, the drip tray 22 may not be used or, if used may be any number of different lengths. Of course, quantitative information is included by way of example only and is not intended as a limitation as to the scope of the invention. Accordingly, it is appropriate that the invention be construed broadly and in a manner consistent with the scope of the invention disclosed.

**ANTIMICROBIAL APPLICATION SYSTEM WITH RECYCLE****Abstract of the Invention**

5

An antimicrobial application system with a recycle system is disclosed. An initial, dilute antimicrobial solution is prepared in a recycle tank in the recycle unit. The solution is provided to the antimicrobial application unit and applied to workpieces, such as raw poultry. After application to the workpieces, the solution is returned to the recycle tank. The concentration of the antimicrobial in the recycle tank is constantly monitored, and additional antimicrobial is automatically added to the recycle tank if the concentration of the antimicrobial in solution falls below a desired amount. At the end of a spray cycle, the solution is diverted to a purge tank, and the antimicrobial is separated from the solution. The separated components are then disposed of in appropriate manners. The antimicrobial is preferably a quaternary ammonium compound, is more preferably an alkylpyridinium chloride, and is most preferably cetylpyridinium chloride.

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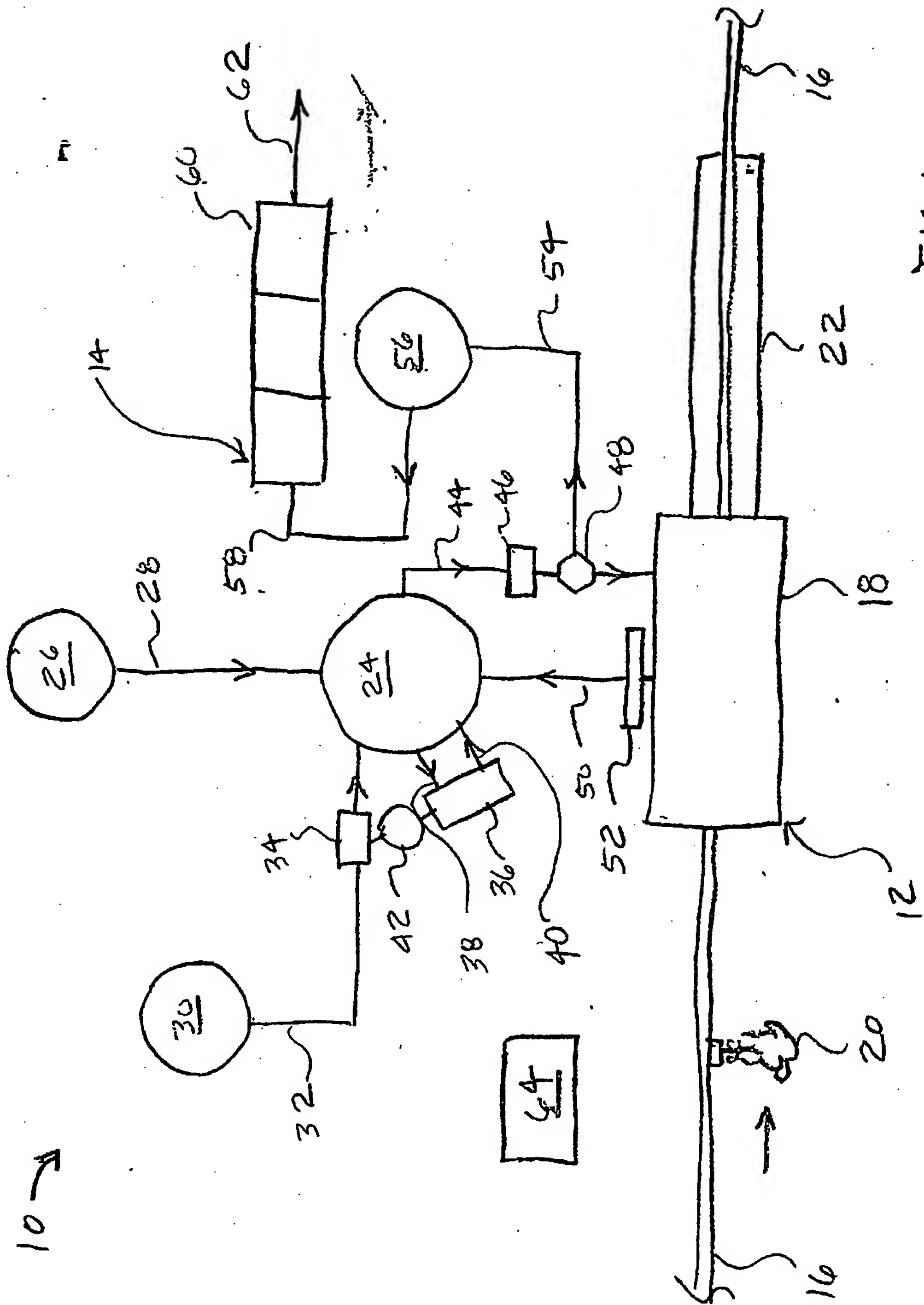


FIG. 1